Focus on GaN & SiC

R&D company Astralux Inc crossed the $1m income mark in 2003, and expects to grow by more than 25% in 2004, breaking revenue records for three consecutive years. The company's activities are focused on commercialising the silicon carbide and gallium nitride semiconductor technology developed by Astralux co-founder and co-owner Jacques Pankove, a member of the University of Colorado, Boulder's electrical engineering faculty from 1985-93. Pankove retired from the university to found Astralux with his wife, Ethel. To date Astralux has focused much more on research. Most funding has come from Small Business Innovation Research grants and broad Agency announcement contracts from the Department of Defense and Defense Advanced Research Projects Agency, Office of Naval Research, Air Force, Missile Defense Agency and National Science Foundation.

The first effort at commercialisation was the spinout of PowerSicel Inc, an SiC semiconductor manufacturer in Boulder in 2001 with seed funding from Denver-based ITU Ventures and headed by former Astralux VP of new products John Torvik and electrical engineering professor Bart Van Zeghbroeck.

Most interest from potential investors is from the data storage industry. Gallium nitride and the push deeper into the blue will make a four-fold improvement in data storage. Astralux's work on energy conversion using hybrid SiC wafers also hold promise with a device that emits hot electrons collected on a colder surface and harvesting the energy difference.

Astralux is funding this research using a $100,000 grant from the Defense Department. Energy harvesting could hold promise for future warrior computing and communication needs that have to be mobile. Where troops rely on generators, Astralux is investigating ways "to harvest a little extra energy" from the vehicles. Converting excess vehicle heat to electricity reduces the heat signature and makes for less target visibility.

Inverse opals

Tungsten inverse opal, created for the first time in a lab at the University of Toronto, is a type of photonic crystal that nearly excludes all light at certain wavelengths. In the University of Toronto case, tiny silica beads are packed into a vessel with tungsten metal introduced in the spaces between the beads and the beads themselves corroded away with acid. The remnant metallic lattice serves as an inverse opal excluding some kinds of light, and possibly even converting what would be waste heat in the form of infrared radiation into more useful wavelengths. Georg von Freymann (freymann@physics.utoronto.ca) has worked on the creation of his inverse opal material and on various absorption effect in the material. Source: Source:http://www.aip.org/enews/physnews/1997/split/pnu348-3.htm

Carbon data storage

Researchers at the Fraunhofer Institute for Material and Beam Technology, Dresden are using modified films containing diamond-like carbon for data storage, resulting in 50x more storage capacity than the best disk drives. For the instrument, ultrafine metal tips like those in STM are used. Thomas Mühl, physicist at the Leibniz Institute for Applied Physics and Materials Research IFW in Dresden, bombards carbon film with electrons from the STM tips to create graphite trenches in the material. The less than 10nm wide trenches are conductive and project above the film surface and both effects store information, says Mühl.

The STM needle serves as a combined, but slow, write and read instrument. High mechanical, thermal and chemical stability of carbon ensures that data can be safely stored for long periods of time.

Researchers are also looking at the possibility of storing and retrieving analogue images for long-term archiving, since it would not require digital conversion programs that may become outdated or unavailable.

An example of the potential is storage of portrait photographs just 1.2 micrometers high. 6.2bn such passport photos would fit on the surface of a postcard, equating to a storage density of over 5,000 Gb/inch^2. Current top magnetic hard drives can achieve 2% of this; commercial drives 1%. The two institutes are working with Fraunhofer spin-off, Arc Precision GmbH to transform the concept into a workable storage technology.

Rad hard 0.15µm Asics & NEPP

Honeywell and Cypress Semiconductor are partnering to produce the industry's first 0.15-µm rad-hard ASICs needed to power satellite communications for the military and for space applications. Honeywell's defense & space electronic systems group has offered 0.35µm and larger rad-hard SoI technologies. But smaller chips are a challenge for aerospace chipmakers. Hence the approach to Cypress as a potential partner to create SoI technologies at 0.15µm. Cypress was looking to add SoI expertise to its portfolio; Honeywell needed help getting down to a smaller node. Honeywell and Cypress partnership will go into full production of rad-tolerant ASICs at 0.15µm at the Cypress fab, Minnesota this autumn. Honeywell begins production of rad-hard ASICs at the 0.15µm at its Minnesota fab mid-2005.

The process will be in place in Q1 of '06. Honeywell is to partner with Synopsys for the 0.15µm node. Synopsys will make advanced ASIC technology and design flows available to the military and aerospace customer .

Also working on radiation effects with extensive research this year for III-V semiconductor systems through the NEPP program is SiGe radiation effects work. The task leads are Drs. Robert Reed and Paul Marshall. This is a multi-agency effort that is evaluating, modeling, and developing mitigation for radiation effects on this ultrahigh speed technology. DARPA's RadHard By Design (RHBD) effort is associated with this task as well. NEPP has also done much work in the past on GaAs reliability and radiation effects.